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AUTHOR Gersten, Russell; And Others
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ABSTRACT

This study investigated the effectiveness of the use of computer networking in providing guided practice in teaching reading comprehension to middle school students (grades 6-8) in remedial reading class. (Guided practice is defined as the phase of instruction immediately following the presentation of a new skill, concept, or strategy, in which the teacher assesses student comprehension of the new skill in order to enhance student achievement in both whole class and small group instruction.) Teachers used TeacherNet, a low-cost prototypic computer networking device that plugs several student keyboards into the communication board of a single personal computer to determine which segments of a curriculum require additional remediation. The reading curriculum consisted of two strands--QAR2 (a meta-cognitive strategy based on the work of Raphael) and rule-based inferences (a strategy for drawing inferences from material implicit in the text). Results indicated a significant effect for rule-based inferences, but not for QAR2. The effect was maintained over a 2-week period. Results indicate the immediacy of feedback was more useful in teaching the abstract and demanding rule-based inference curriculum than the easier, more familiar QAR2 curricula. Students responded positively to the immediacy of feedback and the group accountability involved in the guided practice. A review of prior research introduces the report and the appendix contains copies of sample reading passages and their related questions. (33 references) (Author/SD)

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Guided Practice: Use of Low-Cost Networking.

Russell Gersten, Nancy Golden, John Woodward
University of Oregon

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Abstract

This study investigated the effectiveness of the use of guided practice in teaching reading comprehension to middle school students in remedial reading class. Teachers used a low-cost computer networking system to immediately assess and tabulate student performance to determine which segments of the curriculum required additional remediation. The reading curriculum consisted of two strands--QAR2 (a meta-cognitive strategy based on the work of Raphael) and Rule-Based Inferences (a strategy for drawing inferences from material implicit in the text). Results indicated a significant effect for Rule-Based Inferences, but not QAR2. The effect was maintained over a 2-week period. Results indicate the immediacy of feedback was more useful in teaching the abstract and demanding Rule-Based Inference curriculum than the easier, more familiar QAR2 curricula. Students responded positively to the immediacy of feedback and the group accountability involved in the guided practice.

After observing hundreds of hours of classroom instruction, Anderson, Evertson, and Brophy (1979, p.197) concluded, "At some point during the lesson, the teacher must make a fundamental decision about whether the group as a whole can or cannot meet the objectives of a lesson." Obviously, this decision will be somewhat arbitrary. If teachers wait to make sure that every single student in the group comprehends the new concept, instruction will be extremely inefficient (and boring). On the other hand, the consequences of this decision are serious. If teachers move on to independent seatwork when only a small portion of the group comprehends the material, frustration and confusion will result. Determining when to move on is one of the most complex and subtle aspects of the art and practice of teaching.

The earliest research on this aspect of instruction was conducted approximately 20 years ago by Borg (1965) in the U. S. and Dahllof (1971) and Dahllof and Lundgren (1970) in Sweden. These studies attempted to determine the basis on which teachers gauge their rate of progress through the curriculum for a given class. The researchers contrasted the relative rate of progress through the curriculum of teachers working with heterogeneous classes of students to those working with more homogeneous classes. Using complex statistical models, the researchers attempted to specify what factor or factors determined teachers' rate of progress. Dahllof (1971) concluded that the relative rate of progress was determined not by mean scores for the whole class but by the performance of students at or about the twenty-fifth percentile of each class.

Dahllof hypothesized that teachers base their decision to move ahead or repeat a specific curriculum unit on the performance of a "steering group", a group of students whose performance is approximately at the twenty-fifth percentile. He felt that the steering group probably included students between

the tenth and twenty-fifth percentiles, although it might also include students performing somewhat above above this level. Dahllof reasoned that when teachers see that over one-fourth of their students have not mastered a particular unit, they must spend time reviewing or clarifying the material before proceeding to a new topic. It is important to note that Dahllof (1971, p. 67) cautioned that "the theory of steering in ordinary classroom instruction is, however, provisional...it is based on rather scanty data from two studies (Vaxjo and Utah), neither of which was designed to test just this problem." Furthermore, the steering group model is not based on classroom observation but rather is an extrapolation of the finding that teachers' rate of progress through the curriculum for a particular class is best explained by the performance of students at approximately the twenty-fifth percentile.

The next researchers to address this topic utilized a very different approach, namely direct classroom observation. The observational studies allowed exploration of teachers' decision making on a minute-by-minute basis rather than "over the long haul" as Borg (1965) and Dahllof (1971) had done. Much of this well-known research (Anderson et al., 1979; Evertson, Anderson, Anderson, & Brophy, 1980; Good & Grouws, 1977) contrasted the classroom performance of teachers whose classes made high gains in achievement with the performance of teachers whose classes made minimal gains during the year. From this research, the concept of guided (or controlled) practice evolved.

Guided practice refers to the phase of instruction that immediately follows the presentation of a new skill, concept, or strategy. During guided practice, the teacher assesses the students' comprehension of a new concept or acquisition of a new skill. This is done by assigning a few tasks that require students to apply the new concept or skill and determining if the students can perform these

on their own. If students demonstrate adequate performance, the teacher assigns independent work involving the new concept. If, on the other hand, students perform poorly during guided practice, the teacher provides additional explanations or examples of the concept or provides additional models of how to solve a particular problem.

Research has consistently shown that use of guided practice is correlated with enhanced student achievement in both whole class and small group instruction (Anderson et al., 1979; Good, Grouws, & Ebmeier, 1983). However, few teachers regularly use this procedure (Gall, Gersten, Grace, Erickson, & Steiber, 1987; Good & Grouws, 1977; Evertson et al., 1980). Most demonstrate a concept a few times and immediately proceed with independent seatwork. They do not routinely provide students with one or two practice problems to see if they can solve problems on their own, nor do they ask a series of questions to see if students understand lesson content.

Most teachers base their decisions about curriculum pacing on student performance on unit tests. However, observational research strongly suggests that when teachers assess student mastery on a lesson-by-lesson basis rather than a weekly or monthly basis, achievement is increased. Effective teachers do this by asking students to answer a range of questions, and they do it for a variety of reasons--to activate background knowledge, to promote interest in the lesson, and occasionally to challenge students intellectually with higher-order questions. For example, Evertson et al. (1980) found that the most effective junior high school teachers asked an average of 24 questions within a 50-minute period, while less effective teachers asked only 8.6 questions per period.

Reasons For Teachers' Failure to Use Guided Practice

A major impediment to the use of guided practice is that it is difficult for a teacher to assess efficiently how well all students in a group understand a concept. One reason many teachers infrequently use oral questions as a means to check for understanding is logistical. With a class of 32, or even a reading group of 10, it is not feasible to ask enough individuals questions to see if all students have mastered a concept.

Effective use of guided practice entails equal distribution of questions among all students in the group (Anderson et al., 1979; Brophy & Evertson, 1974, 1976; Groisser, 1964; Loughlin, 1961). However, observational research consistently shows that in a typical classroom, students do not get equal opportunity to respond. Teachers call on students who volunteer, and these are often the brightest students (Brophy & Evertson, 1974). Thus, teachers' assessments are based on the students who tend to learn the fastest. Lower-performing students, who potentially could provide the most diagnostic information to teachers in terms of whether more time should be spent on a specific skill, often provide the least. As a result, some low-performing students begin seatwork without being able to work independently (Hayden, 1988).

Techniques for Distributing Questions

Awareness of these problems has led teacher educators to advocate several teaching strategies, all of which encourage an equal distribution of questions to all students during guided practice. One technique is to call on students randomly. There is little research to support this technique (Rosenshine & Stephens, 1984) . The single study that investigated the issue, Anderson et al.'s (1979) research on first-grade, small-group reading instruction, found that random selection of students was not as effective as the use of ordered turns.

Even when teachers used unsystematic "random" procedures, they forgot to call on some students in the group. The "forgotten" students often included some of the lower-performing students. Furthermore, when teachers try to assure everyone is called on, they must constantly try to remember which students have already been asked a question. This requires teachers to focus on management rather than on other aspects of instruction (Anderson et al., 1979).

The use of ordered turns has been found to be related positively to achievement in first-grade reading (Anderson et al., 1979). Research in high school mathematics also suggests that ordered turns may enhance the achievement of low-performing students (Gall et al., 1987). It helps prevent over-eager students from dominating the action and insures that reluctant students participate. However, Anderson et al. (1979) found that most teachers do not use this technique. Those teachers surveyed felt that if students knew when they were going to be called on, they would not attend at other times.

A technique recommended by Becker (1977) for equal distribution of teachers' questions is choral (group) responding. The results of studies investigating the effectiveness of this technique are equivocal (Rosenshine & Stevens, 1984). Two studies found that questions requiring group responses created greater attention and higher achievement than questions to individuals (McKenzie, 1979; McKenzie & Henry, 1979). Two other studies found that teachers' use of group choral responses was negatively related to achievement (Anderson et al., 1979; Brophy & Evertson, 1976).

Another possible option, suggested by Clark and Peterson (1986), is to call on students in the steering group (i.e. those students between the tenth and twenty-fifth percentiles of the class) to assess whether the group or class is ready to move on. The advantage of this technique is that teachers could

reasonably assume that if the lowest-performing students in the class had mastered the concept, the whole class was ready to move on. This technique, too, would have some definite disadvantages. The three to six students in the steering group would likely feel "picked on" if they were asked constantly to serve as barometers and received many more questions than other students. Similarly, the other students in the class might feel ignored. Finally, low achievers tend to make more mistakes and thus the issue of embarrassment arises.

Each of the techniques discussed above has advantages and disadvantages. Another means of distributing questions is computer networking (Woodward, Carnine, Gersten, Moore, & Golden, 1987). Although there are many commercial forms of this technology, the relatively inexpensive version used in this study seems most viable for public schools. Low-cost networking systems only require a keypad for each student and one central microcomputer to process the answers entered through the keypads. Details of this system appear in the Method section below.

With computer networking, it is possible for the teacher to know immediately how all students respond to each question. In addition, information can be provided on the percentage of correct answers for an entire class, allowing teachers to gauge students' success rate during guided practice.

The system can enable teachers to use guided practice to assess whether the group needs extra time on a skill or concept or is ready for independent work. Teachers can create an answer key for questions to be asked during guided practice. The screen immediately indicates the proportion of students who have correctly answered a question. If this proportion is less than a set criterion, the teacher can then immediately provide additional review or remediation.

The purpose of the study reported in this article was to evaluate the effectiveness of computer networking in providing guided practice in teaching reading comprehension to a group of low-achieving middle-school students in a "pullout" remedial reading program. Whereas former research (Anderson et al., 1979; Good & Grouws, 1979) evaluated the use of guided practice as part of a package of effective teaching techniques, our study isolated guided practice as a unique independent variable.

An experimental and comparison group were taught the same curriculum for the same length of time. All aspects of instruction provided to the two groups (content of the curriculum, number and type of examples presented during teacher demonstrations, use of praise, minutes allocated to active teaching, rules for deciding when remediation was necessary) were identical except that the experimental group received guided practice. Computer networking provided the teacher with information for determining the nature and extent of guided practice necessary.

Reading comprehension was selected as the content because it is a relatively complex cognitive activity, that involves a large number of application exercises and thus many opportunities for the teacher to provide feedback. Therefore, it seemed fertile ground for research on guided practice.

Method

Subjects

The study involved 31 middle-school students in grades 6, 7 and 8 who were receiving remedial instruction in reading. All students were at least 1 year below grade level. These students were given the Reading Comprehension subtest (Level 16) of the California Achievement Test (CAT). Students were

paired based on their CAT scores; one member from each pair was then randomly assigned to one of two experimental conditions.

The mean raw score on the CAT for the guided practice group was 22.44, with a standard deviation of 7.2. For the comparison group, the mean was 24.43, with a standard deviation of 7.7. The difference between the groups was not significant. There were 9 girls and 8 boys in the guided practice group, and 3 girls and 11 boys in the comparison group.

Teachers. The senior author and a research assistant, both certified teachers, taught the two groups. On the sixth day of the intervention, the two teachers switched conditions to control for teacher effects.

Curriculum

Both groups received instruction in the same reading comprehension curriculum. The curriculum included two components. The first, QAR 2, was adapted from Raphael and Wonnacott's (1985) metacognitive instructional procedure. This strategy has been demonstrated to be effective in improving comprehension by teaching students the relation between comprehension questions and the sources of their answers. The procedure teaches students to discriminate between questions whose answers are text-explicit or "right there" and those that are text-implicit (i.e., require students to search for clues in other parts of the passage). The types of questions students encountered were similar to those they typically encounter in basal reading series, although instruction was more systematic than is typical in a basal series. Instructional passages came from two major sources: the HBJ Bookmark Reading Program (Early, Canfield, Karlin, & Schottman, 1979) and a remedial series, the Corrective Reading Program--Comprehension B (Engelmann, Osborn, & Hanner, 1978). The materials used from the HBJ series were taken from the

fifth- and sixth-grade levels of the program that corresponded to the students' assessed reading levels.

The second component taught students how to make rule-based inferences. The instructional procedures were based on research by Carnine, Kameenui, and Woolfson (1982). At the beginning of a reading selection, students were given a rule defining a character's basis for making a decision (e.g., "The Fuentes family wants to take the shortest possible route to Fresno."). Each passage contained considerable irrelevant information, such as, "If you take Highway 99, you'll pass a lot of beautiful scenery," or "If you take Miller's Road, you'll pass a lot of gas stations. That's good if you have car problems."

Instruction began by the teachers presenting short paragraphs. After reading a rule at the beginning, students read the rest of the paragraph and were told to compare each sentence to the target rule statement. In doing so, they were taught how to determine whether the sentence contained important or irrelevant information. As the 12-lesson unit progressed, students read increasingly longer passages that contained more distracting and irrelevant information.

Networking System

This research used Teacher Net , a prototypic computer networking device that uses several keypads for student responses. These keypads or keyboards are plugged into a communication board in a single IBM or IBM compatible computer. Prior to each day's lesson, teachers created an answer key for the 15-20 questions that would be asked that day. Answers, entered from keyboards at each student's desk, were compared to the answer key created by the teacher. The Teacher Net system indicated the percentage of students who recorded a correct answer to each question.

Procedures

Structure of daily lessons. All students were instructed for 40 minutes daily for 17 days. In both groups, the first 20 minutes were spent in a lecture-demonstration format. The teacher followed the Good and Grouws (1979) active teaching model. After reviewing pertinent material from previous lessons, she provided several models of how to apply the comprehension strategy.

In the experimental or guided practice group, the teacher spent the remaining 20 minutes of this time asking students to respond to 15-20 questions, using the computer networking system and providing relevant feedback. The teacher presented the questions, one at a time, on an overhead projector and provided immediate reteaching or correction for each question for which the group's score was less than 80% correct.

Students sat at their desks and entered their answers to questions through numeric keypads. Responses were judged by an answer key already created by the teacher. The computer monitor screen, which faced the teacher and not the students, showed performance on each question, and cumulative performance by the group as well as by individual students thus far in the lesson. An asterisk appeared next to the names of students performing below 80% correct. If more than 20% of the students made an error, the teacher immediately provided a correction procedure. (See Correction Procedures below for details.)

In the comparison group, 15 minutes out of the 40 minutes was also spent asking students to respond to the same 15-20 questions. However, for this group the questions were presented in the form of a worksheet. After class, the teacher corrected these worksheets to determine which concepts needed to be retaught. During the first 5 minutes of the next day's class (before the lecture-demonstration phase), the teacher provided feedback and reteaching

for all items that more than one-fifth of the students missed. The reteaching and correction procedures were identical to those used with the guided practice group. By following this convention, the time for modeling and practice on application items remained the same for both groups, whereas the groups varied as to when they received feedback on their performance (i.e., immediately for the guided practice group or the next day for the comparison group).

Lecture-Demonstration. Both the guided practice and the comparison groups received identical content for the lecture-demonstration phase. This phase started with the teacher introducing or reviewing vocabulary words students needed to understand in order to comprehend the worksheet questions. Next the teacher introduced the principle or strategy that they would use in the comprehension items for that day's lesson. The teacher worked through several application exercises. Then the students began working on questions.

Questions in the guided practice condition. Following this group's lecture-demonstration phase, a series of questions were presented on the overhead projector. These questions concerned specific concepts, skills, or strategies recently taught in the lecture-demonstration phase. A total of 15 to 20 questions were presented each day. They were interspersed throughout the lesson. During each lesson, approximately 20 minutes were allocated to lecture-demonstration and 20 minutes to questions.

The students were given a specified amount of time to read the selection and each of the four choices for a question. This time depended on the length of the question and it varied from 30 seconds to 3 minutes, with the average being about 1 minute.

The teacher signalled the students, as a group, to enter their responses to a question into the computer. If the group's cumulative score was 80% or better, the teacher continued the lecture. If the cumulative score was less than 80%, the teacher retaught by providing the correction procedure.

Worksheet questions in comparison group. In the comparison group, the teacher gave a 20-minute lecture-demonstration covering the same material as in the guided practice group. After each new concept was presented, she stopped and asked if there were any questions. The teacher responded to student questions with a brief explanation or by repeating the rule (i.e., reteaching). At the end of the lecture, 15 minutes were given to complete a worksheet. The worksheet contained the same 15-20 questions that were presented on the overhead projector for the guided practice group. The teacher corrected and analyzed the worksheets later that day. If the group's cumulative score was below 80% on a given item, the teacher provided the identical correction/reteaching procedure that was used with the guided practice group.

Reteaching/correction. Both the guided practice and comparison groups received the same reteaching/correction procedures when more than one-fifth of the students made an error. The teachers used two types of feedback--facilitative feedback (Rosenshine & Stevens, 1984) or elaborated feedback (Collins, Carnine, & Gersten, 1987). Typically, if the group made an error, the teacher provided a clue to help them reach the answer. This might involve a simplified rephrasing of the question. If students were unable to reach the right conclusion after facilitative feedback, the teacher would guide them through the steps in the strategy (elaborated feedback).

At the end of this correction/reteaching segment, the teacher asked if there were any questions. If there were questions, the teacher answered them by providing an additional example and/or repeating the rule or steps in the

strategy. The teacher gave only one additional example and/or repeated the rule only once.

These procedures ensured that the two groups moved through the curriculum at a similar pace. In addition, to ensure that each group finished at the same place in the daily lectures, the teacher stopped at designated points. When this occurred before the lecture period was over, the teacher provided students with content unrelated to the reading comprehension curriculum.

Measures

Student mastery of the curriculum was assessed on two paper and pencil multiple-choice tests. These tests were given on the day following instruction, and again, as a maintenance test, 2 weeks later. Items on the tests were taken from a variety of sources: content-area texts, commercial reading anthologies, and the CAT. Some items were developed by the experimenter. All items for the two tests were selected on the basis of their relevance to the skills and strategies covered in the two components of the curriculum. Some items or passages closely paralleled those used in the study, while others were more complex or difficult than those that had appeared in the curriculum used in the intervention.

The QAR2 Test asked students to discriminate literal from inferential comprehension questions and correctly respond to them. After answering each question, students were asked whether the answer was "right there" in the sentence or whether they had to search for clues throughout the passage. The test contained 26 items, divided evenly between text-implicit and text-explicit questions.

The second six-item test covered rule-based inferences. Students were asked to utilize the rule at the beginning of each passage and the relevant

information contained in the paragraph to make an inference about what a character in the a passage should do. These paragraphs contained a good deal of irrelevant and distracting information. Examples of each type of test item are presented in the appendix.

Forty-one sixth graders in two language arts classes served as a standardization sample. These students had no exposure to the experimental curricula. Coefficient alpha reliabilities were .65 for the QAR 2 test and .67 for the rule-based inferences test. Both are adequate for evaluation research (Cook & Campbell, 1979).

Student engagement data were collected every other lesson by a research assistant. These data were collected during the entire period, including both the active teaching segment and the independent seatwork segment. Each student was observed once every 10 minutes. The observer recorded whether the student was on task, or engaged in some other activity (e.g., looking around, talking to another student, playing with an object).

Results

Student Mastery

The major intent of the study was to examine whether a computer networking system of guided practice would enhance low-achieving students' acquisition of material. Student mastery was assessed on two tests, The QAR2 Test and the rule-based inferences test. Table 1 presents the results on the two immediate post tests. Scores on the QAR2 test are virtually identical for the two groups; they correspond to an 88% mean accuracy level. On the 10-item rule-based inference test, the mean scores are 5.12 for the guided practice group and 3.79 for the comparison group. The descriptive statistics indicate that the rule-based inference questions were difficult for this population of students.

Even the guided practice group's mean scores indicate that they answered only 51% of the questions correctly.

[Insert Table 1 here]

Table 2 presents results of maintenance tests, given 2 weeks later. The pattern is similar to the post test. The two groups' scores on the QAR2 test are not significantly different, whereas the guided practice group performed significantly better than the comparison group on the rule-based inferences test.

Separate 2 X 2 ANOVAs with repeated measures were performed on each of the two tests. The between-subjects factor in each analysis was instructional method; the within-subjects factor was time of testing. No significant effects were found on the QAR2 Test. However, for the rule-based inferences, the ANOVA revealed a significant main effect for instructional method; $F(1,28) = 8.01$, $p < .01$. On both testing occasions the guided practice group performed significantly better than the comparison group.

[Insert Table 2 here]

These results indicate that the guided practice had a significant positive effect on students' acquisition of the more complex material in the rule-based inferences curriculum but had no discernible effect on their performance on the more familiar material in the QAR2 test. The effect on the rule-based inferences curriculum was maintained over a 2-week period.

Academic Engagement

The observational data on student engagement rate indicated a sizeable difference between the two groups. The median was 88.9% for the guided practice group and 51.9% for the comparison group. Though no formal statistical tests can be performed on these data, they do suggest that the use of the networking system to provide immediate feedback based on group performance resulted in increased student engagement and involvement.

Students' Reactions to the Intervention

Students' reactions were probed in a brief 5-minute interview administered during the last few days of instruction. The results were coded using a keyword technique. Seventy-nine percent of the guided practice group indicated that they liked the instruction, while only 25% of the comparison group admitted to liking the instruction. When students in the guided practice group were asked what they liked about the instruction, 57% gave reasons that dealt with the immediacy of feedback (e.g., "It was easier, you used the keypad, and found out your answer right away," or "Everything was explained right away," or "Getting feedback, because it showed how you did on your work.")

Discussion

Guided practice led to superior results in the rule-based inference comprehension activities but did not enhance student performance on the much less demanding and more familiar QAR2 activities. These results suggest that guided practice is most useful for instruction in newer and/or more complex cognitive skills.

The differential effectiveness of guided practice in this study can be explained by examining the demands of the two components of the comprehension curriculum. QAR 2 was intended to enhance and expand conventional comprehension activities. In describing the QAR system, its developer, Raphael (1982, p. 190) noted: "QARs have always been implicit in answering questions. The value of this program lies in its very lack of novelty. The program merges easily with current instruction." The purpose of this instruction is to help develop students' metacognitive awareness of activities that they frequently engage in. Thus, Raphael recommends using typical questions from basal series. This is what we did in the current study.

The majority of the basal questions were literal; some required simple inferences or rule applications (Beck and McKeown,1981). For example, the first QAR2 question (see appendix) required students to apply the simple rule that the Olympic Games take place every 4 years. Students n the standardization sample (sixth-grade students who received no instruction on either QAR2 or rule-based inferences) had an easy time with items like this. One hundred percent of the students successfully answered this question. Question 3 required literal comprehension, and 80% of the standardization students responded correctly. Question 5 merely required students to know that July is in the summer and to relate this fact to the material in the text; 93% of the students answered this correctly. In fact, for the basal questions, the mean percentage of students in the standardization sample answering each question correctly was 83, with a range of 53.3 (for question 7, Appendix) to 100. The types of questions they were asked to answer were similar to the questions in basal series that they had been answering for the past 6 years.

Students also seemed to find the metacognitive aspects of the QAR2 process easy. Though the students had no prior formal instruction in discriminating literal from inferential questions, they seemed to learn this skill quite easily Students in the standardization sample scored from 80 to 90% correct on these items with no formal instruction. The remedial students in the study learned this skill after several lessons, as Raphael (1982) predicted. This is evidenced by the high scores for both groups in the study on the QAR2 test. Because so few errors were made in this curriculum component, there was little need for teachers to provide elaborate, detailed feedback to students. In all likelihood, this explains the lack of a treatment effect for this aspect of instruction.

In contrast, the rule-based inference material was clearly unfamiliar and difficult. Students in the standardization sample had problems with all items in the rule-based inferences segment. The mean percentage of students answering each item correctly was 27; the range was between 7% and 47%.

There are several reasons why remedial students would find the rule-based inference items much more difficult than QAR2 items. Keeping a rule statement in mind while reading a lengthy passage containing distracting information is a complex cognitive task. One must constantly refer to the rule, either mentally (or sometimes visually) while reading the next unit of information. The learner must weigh each piece of new information and discern what is important and what is distracting. Finally, a summative inference must be made in the form of what action a character must take (e.g., which donuts to buy, what route to drive). This type of inference is far more complex than applying the "4-year rule" to the Olympics.

The passages intentionally included a good deal of distracting information. Though there is little research specifically evaluating the influence of distractors on comprehension, the data from the standardization sample strongly suggest that items with distracting information, or items requiring discriminations, were much more difficult. For example, the most difficult item in the QAR section of the test was item 7, "Where did the first Olympic Games take place?" Almost half of the students responded incorrectly, naming Athens as the site of the first **modern** Olympic Games rather than Olympia, the site of the first Games. The QAR segment contained few other distractors of this nature; they occurred constantly in the rule-based inference segment.

In these passages, students were often asked to make a decision that violated folk wisdom or to have the character make a decision that would be quite different than one they themselves would make (e.g., choose fruit over ice

cream, or choose a lower-paying job over a higher-paying job). All of these factors increase difficulty (Patching, Kameenui, Carnine, Gersten, & Colvin, 1983).

Neither basal reading programs nor middle-school curricula tend to teach this kind of comprehension process (Durkin, 1978-1979). Therefore, remedial students would have difficulty learning the new process and would tend to make a number of mistakes in the first stages of learning. Guided practice on rule-based inferences allowed the teacher to give immediate feedback when students were incorrect or confused. The teacher could immediately explain why certain sentences in the paragraph were important (i.e., why they pertained to the initial rule), and why other sentences were simply irrelevant or distracting.

In teaching the rule-based inference curriculum, the teacher was able to provide step-by-step explanations to the group as problems arose. This allowed the students who had made an error immediately to see how a complex process could be broken down into smaller units of information and how the problem could be solved. The teacher not only identified distracting information but also explained why it was not germane to the character's major problem.

An unexpected outcome of the study was that the networking led to a form of cooperative learning (Johnson, Johnson, & Holubec, 1986; Slavin, 1983). Since the teachers knew which students had reached the right conclusion (through the information on the computer screen), they could ask some of these students to explain their reasoning to the other students. In addition, teachers reported that the group contingency of 80% accuracy served as an incentive for the group as a whole. Students would occasionally tell their peers to pay attention or to work harder so that the group could move more

quickly. This use of group contingency is also a component of cooperative learning.

The results of the study can be interpreted to mean that it is more effective to provide students with immediate feedback on their performance than to give them delayed feedback on an individual basis the next day (as was done in the comparison group). This finding is important because teachers rarely provide students with immediate feedback (Anderson et al., 1979, Evertson et al., 1980, Gall et al., 1986). The interview responses students in the guided practice group gave regarding the networking system indicate that they found that the immediate feedback was the most beneficial part of the system. They stated repeatedly that they liked the keypad system because when a question was missed, "you found out your answer right away." They definitely preferred the immediacy of the feedback to their typical classroom practice of finding out how they did at the beginning of the next day's lesson when their seatwork was handed back to them.

The computer networking system used in this study is one tool for enabling teachers to provide guided practice and immediate feedback. Other techniques include the use of random turns, ordered turns, unison responses, and the use of a steering group. Each of these procedures seems preferable to the most commonly used system, reliance on volunteers. Calling on volunteers can give the teacher a false sense of group progress as well as exclude many shy or lower-performing students from interactive instruction. However, as discussed previously, management problems are associated with each of these guided practice techniques.

The networking system used in this study appears to overcome some of the major problems associated with these other techniques. If teachers only move forward when 80% of the group has responded correctly, they are

implicitly using the steering group's performance, without embarrassing these students. The computer can record these students' responses for teachers, allowing them to know which students are likely to require assistance during independent seatwork time.

There may have been some sort of novelty effect involved in this study. Students may have responded more attentively and carefully for two reasons--the novelty of using feedback and the novelty of receiving immediate feedback. It is important, also, to note that all participants in this study were remedial reading students. It is unclear whether these techniques would be as useful for average-ability students. The results do clearly indicate the importance of providing more guided practice and immediate feedback to students in the at-risk category.

The intent of this study was to evaluate the effects of integrating computer networking with empirically-derived effective teaching practices. The results indicate that this merger was effective in teaching the more complex cognitive activity but not particularly helpful when students worked on easier, more conventional comprehension activities.

Appendix

Sample Questions

QAR2

Directions: Read the following selection. Then answer the questions on your answer sheet.

Did you know that the Olympic Games have their roots in ancient Greece? That is where the very first Games took place in 776 B.C., in Olympia.

Like the Games of today, the Games of 2,700 years ago were held every four years. It is only in this way that the two Games are the same. The ancient Games were held only in the summer, and at first only men were allowed to take part. It was only at the end of the 6th century B.C. that separate Games for women began to be held. Today, of course, men and owmen compete in both summer and winter sports. In the first Olympics, only running skills were tested. Within 125 years, new sports were added, including boxing and wrestling.

The Games of today include almost every sport you could think of, from ice dancing to diving, from speed skating to swimming. Only Greek people played in the ancient Games. Now, of course, any country in the world can take part in the Olympics.

The ancient Games remained a peaceful way for people to compete until the end of the 4th century A.D. That is when the Roman rulers of Greece, led by Emperor Theodosius I, ordered an end to the Games.

The first modern Olympics took place in 1896 in Athens, Greece. Greece was chosen because that was where the original Olympic Games were held. Many events we still enjoy today were added to those from the ancient Games. The 1896 Games were not very successful.

Women were not allowed to take part in the modern Olympic Games until 1912. These Games were held in Stockholm, Sweden. As is still true today, women could not compete against men in the same events.

In the first twenty-eight years of the modern Games, only skill in summer sports was tested.

Directions: Circle the best answer.

1. If the last Olympic Games were in 1983, when would the next Games be?

   a. 1987 b. 1979 c. 1980 d. 1990

2. How did you get this answer?

   a. Right there
   b. Clues

3. Why did the ancient Games end?

   a. because women weren't allowed to take part in the Olympics.
   b. because only skill in summer sports was tested.
   c. because the Roman rulers ordered an end to the Games.
   d. there weren't enough sports.

4. How did you get this answer?

   a. Right there
   b. Clues

5. Which month could the ancient Olympic Games have taken place?

   a. January
   b. October
   c. July
   d. December

6. How did you get this answer?

   a. Clues
   b. Right there

7. Where did the first Olympic Games take place?

   a. Lake Placid
   b. Athens
   c. Olympia
   d. Chamonix

8. How did you get this answer?

   a. Clues
   b. Right there

Rule-Based Inference

Jack is looking for a part-time job after school. "I have been looking for a job for two weeks, but can't find what I want," he said to his dad. "All I really care about is working after school and making over $4 an hour. Can you help me find a job, Dad?"

"There is a job in the paper that sounds good," Jack's dad said. A local family restaurant is looking for a busboy. Your responsibilities would be to clean tables, mop floors, and wash dishes. You would have to start work at 8 in the morning. The job pays $3.25 per hour."

"There is another job listed that you might like. You would begin work at 5 o'clock in the evening. The job pays $4.50 per hour. The position is a box boy and Food and Go Market. Your responsibilities would include bagging groceries, assisting customers, and stocking shelves. No experience is required, and you could begin right away."

1. Which job will Jack take?

   a. busboy at restaurant
   b. box boy at Food and Go Market

2. What reason would Jack use to decide on the job?

   a. "A local family restaurant is looking for a busboy."
   b. "Your responsibilities would be to clean tables, mop floors, and wash dishes."
   c. "The position is a box boy at Food and Go Market."
   d. "You would begin work at 5 o'clock in the evening."

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Table 1

Correct Answers on the Immediate Posttest
by Subject and Instructicanl Group

Instructional Group		CAR2		Rule-Based Inferences	
	N	M	SD	M	SD
Guided Practice	16	25.8	6.3	5.12	2.2
Comparison	14	25.1	4.4	3.79	2.0

Table 2

Correct Answers on the Maintenance Tests
by Instructional Group

Instructional Group		CAR2		Rule-Based Inferences	
	N	M	SD	M	SD
Guided Practice	16	28.3	4.5	6.68	1.4
Comparison	14	24.9	4.1	4.57	2.2